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Method and device for recognition of a tear-off strip
on a material web

Description

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The invention relates to a method for detecting, with the aid of sensors, a tear-off strip or tear-off thread applied to a material or film web. Furthermore, the invention relates to an apparatus for implementing the method.

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During the production of packs with external wrapping made of film, in particular cigarette packs or cigarette multi-packs, the film is provided with a tear-off thread or a tear-off strip, in order to make it easier to remove the outer wrapping when the pack is put into use. The tear-off strip is applied to a continuous material web or film web and joined to the latter. After that, the blanks for wrapping the pack are severed from the web (EP 1 209 083).

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The presence and the correct positioning of the tear-off strip on the material web are checked (continuously). For this purpose, in the prior art, optoelectronic and capacitive sensors are used, which are aimed at the material web in the region of the tear-off strip. The sensors react to markings on the tear-off strip which can be registered optically.

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The optoelectronic registration of the tear-off strip or tear-off thread fails if there is no adequate optical contrast or if, for example, the material web is entirely or partly printed or metallized.

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The invention is based on the object of detecting a tear-off thread or tear-off strip on a material web or

film web without contact, specifically irrespective of any optical contrast.

In order to achieve this object, the method according to the invention is defined by the following features:

- a) the sensors for detecting the tear-off strip or tear-off thread are ultrasonic transmitters, on the one hand, and ultrasonic receivers, on the other hand, which are positioned on different sides of the material web,
- b) ultrasonic transmitter and ultrasonic receiver are aimed substantially exactly at the tear-off thread or tear-off strip,
- c) the ultrasonic transmitter is constructed in such a way that a lobe or response curve generated by the latter corresponds approximately to the width of the tear-off strip,
- d) the ultrasonic receiver is connected to an evaluation unit which reacts to changes in the intensity of the waves picked up.

Testing thin-walled workpieces by means of ultrasound is basically known. Hitherto, this detection method has been used in double-sheet control, that is to say in checking (equally sized) sheets of thin material, in particular paper, with regard to any double-layer nature.

The invention is based on the finding that, by means of ultrasonic sensors, the position of a narrow material strip, mainly of a tear-off strip or tear-off thread, on a continuous thin material web is possible, specifically during continuous testing. For this

purpose, the transmitter and receiver are aimed specifically at the tear-off strip or tear-off thread in the exact position of the same. The material web having tear-off strips or tear-off threads is
5 preferably moved continuously past transmitter and receiver, in such a way that the ultrasonic waves are aimed in a concentrated manner at the region of the tear-off strip or tear-off thread.

10 In this case, according to the findings of the invention, the response curve of the receiver can deviate (slightly) from the width of the tear-off strip, as long as a measurable difference is provided by the receiver when picking up the ultrasonic waves in
15 order to differentiate between an existing tear-off strip and a missing tear-off strip. The dimensioning of the lobe or response curve can then be determined by the intensity of the transmitter. One special feature, however, is the configuration according to the
20 invention of the transmitter in such a way that the latter has an aperture stop that reduces the free transmitter area and which has the effect of a specific, limited response curve.

25 Further details of the invention relate to the expedient arrangement of the testing elements within a (packaging) machine.

Further special features of the invention will be
30 explained in more detail below using exemplary applications and embodiments.

Fig. 1 shows a packaging machine for wrapping
(cigarette) packs in a film wrapper, in a
35 schematic side view,
fig. 2 shows a detail II from the view according to
fig. 1 on an enlarged scale,

fig. 3 shows a further enlarged detail III from fig. 2,

fig. 4 shows a detail of an ultrasonic transmitter, namely a plan view IV-IV of fig. 3,

5 fig. 5 shows the schematically illustrated mode of operation of ultrasonic transmitter and ultrasonic receiver when a tear-off strip is missing,

10 fig. 6 shows a corresponding illustration with a correct tear-off strip.

The exemplary embodiment shown concerns the production of box-like packs 10, specifically cigarette packs, which are provided with an outer wrapper made of film.
15 This has a tear-off strip 11 or a tear-off thread, which is positioned at a specific point in order to make the opening operation of the closed pack possible.

The tear-off strip 11 is applied to a continuous material web 12 of film for this purpose. The latter
20 is drawn continuously from a reel 13. The continuous tear-off strip 11 is drawn from a strip reel 14 and, during transport in the same direction, is pressed onto the material web 12 and joined to the latter by a
25 pressure roll 15. The unit comprising material web 12 with tear-off strip 11 is then supplied to a blank-cutting unit 16. In the region of the latter, individual blanks - with tear-off strip 11 - are
30 severed from the material web 12 and respectively folded around a pack 10. The apparatus for handling the tear-off strip 11, the material web 12 and for producing the blanks expediently corresponds to EP 1 209 083.

35 It is necessary to check whether the material web 12 is provided with a tear-off strip 11 and whether the latter is positioned correctly. A testing unit 17 is

used for this purpose. This operates without contact on the basis of ultrasonic waves. An ultrasonic transmitter 18 and an ultrasonic receiver 19 are positioned on opposite sides of the material web 12.

5 The ultrasonic transmitter 18 aims ultrasonic waves specifically at the material web 12, specifically in the region of the tear-off strip 11. The opposite ultrasonic receiver 19 picks up the sound waves. Transmitter, receiver and an evaluation unit connected
10 to the receiver are constructed in such a way that any fluctuations in the intensity of the received ultrasonic waves are evaluated and findings relating to the presence or lack of a tear-off strip 11 can be obtained from this. The action of the testing unit 17
15 is such that, given the presence of a tear-off strip 11, attenuation by the tear-off strip 11 of the sound waves emitted occurs and, in the region of the ultrasonic receiver 19, leads to considerably reduced reception.

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The testing unit 17 is positioned in the region of a vertical web section 20 of the material web 12, specifically following a deflection roll 21 immediately above or in the conveying direction upstream of the
25 blank-cutting unit 16. In the present exemplary embodiment, the testing unit 17 is accordingly positioned immediately above a suction belt 22 for the transport of the material web 12 and the severed blanks in the region of the blank-cutting unit 16. It is a
30 matter of carrying out the testing of the tear-off strip 11 as immediately as possible before the severing of the blank. The testing is advantageously after the last deflection roll 21.

35 Transmitter and receiver are arranged such that the ultrasonic waves are directed along an obliquely oriented axis 23 in an idealized manner. Accordingly,

the ultrasonic waves are aimed at the material web 12 at an acute angle to the latter. The ultrasonic transmitter 18 is in this case located on the side of the tear-off strip 11, and the ultrasonic receiver 19 is located opposite on the side of the material web 12. The angle of the axis 23 with respect to the plane of the material web 12 is approximately between 70° and 45° . The distances of transmitter and receiver from the material web 12 are likewise different. The ultrasonic transmitter 18 is at a short distance, about 5 mm to 15 mm, from the material web 12, and the receiver 19 is at a greater distance of 15 mm to 65 mm. Alternatively, transmitter and receiver can be arranged transversely or at right angles with respect to the web 12.

The ultrasonic sensors are constructed in a particular way, so that a defined, limited lobe or response curve of the sound waves is produced, which is aimed exactly at the region of the tear-off strip 11. The defined response curve, approximately of the width of the tear-off strip 11, can be produced by an appropriate construction of the ultrasonic transmitter 18. In particular, the ultrasonic transmitter 18 can be provided on the outlet side with an aperture stop 24, which limits the emergence of the sound waves. In the exemplary embodiment shown in fig. 4, the aperture stop 24 is formed in such a way that the ultrasonic transmitter 18 (of circular cross-section) has a central gap 25 running diametrically. This forms the outlet area for ultrasonic waves. The gap 25 extends in the direction of the tear-off strip 11. A focused region of the sound waves is aimed through the aperture stop 24 or the gap 25 by the ultrasonic transmitter 18 at the material web 12 in the region of the tear-off strip 11.

The course of the "lobe" or the response curve of the ultrasonic waves is shown schematically in fig. 5 and fig. 6, fig. 5 showing the case of a missing tear-off strip with sound waves passing largely unhindered through the material web 12. Fig. 6 is the illustration of the correctly formed material web 12 with tear-off strip 11. The sound waves originating from the ultrasonic transmitter 18 are absorbed completely or predominantly by the material web 12 with tear-off strip 11, so that the ultrasonic receiver 19 receives no sound waves or highly attenuated sound waves.

The evaluation unit (not shown) generates a signal when the material web is not correctly provided with a tear-off strip 11, with the effect of fig. 5.

List of designations

- 10 Pack
- 11 Tear-off strip
- 12 Material web
- 13 Reel
- 14 Strip reel
- 15 Pressure roll
- 16 Blank-cutting unit
- 17 Testing unit
- 18 Ultrasonic transmitter
- 19 Ultrasonic receiver
- 20 Web section
- 21 Deflection roll
- 22 Suction belt
- 23 Axis
- 24 Aperture stop
- 25 Gap